a continuous period of nearly one hundred hours, at an average velocity of 39 miles per hour, and on April 15 the velocity for the entire twenty-four hours was over 52 miles per hour. This hurricane-like wind was accompanied by fine drifting snow, which was like sand, and so filled the air that one could not see a dozen yards. The Seventh Regiment, United States Cavalry, was encamped at Yankton at the time, and for more than forty-eight hours officers and men alike were obliged to seek shelter in the houses of the citizens."

The atmospheric conditions attending the storm of January 12, 1888, are thus described in the Weather Bureau MONTHLY WEATHER REVIEW for that month: "On the morning chart of the 12th an area of high pressure appeared north of Montana. On this chart was also shown a well-defined area of low pressure central near Cheyenne, Wyo., the subsequent course of which was to the southeast till central near Concordia, Kans., at 3 p. m., then rapidly to the northeast. At 10 p. m. of the 12th the area of high pressure had extended to the southeast over Montana, Dakota, and Nebraska, while the pressure at its center had increased to 30.60 inches, the center of the area of low pressure before mentioned being located at La Crosse, Wis., and bounded by an isobar of 29.60 inches, there being a difference of pressure of 1.3 between the centers of the two areas, separated by about 1,200 miles. This marked difference in pressure caused winds of from 30 to 50 miles an hour, accompanied at some stations in Montana, Dakota, and Nebraska, by snow, which, with a fall of from 30° to 60° in temperature during the twenty-four hours preceding the 10 p. m. observation of the 12th, helped to make a violent storm in which many lives were lost and large numbers of cattle perished."

There is much similarity in the movement of the storm center in this and the storm of January 2–4, 1897. The latter did not move nearly so fast, to which can be attributed the length of the storm and the great amount of precipitation. On the morning of the 2d an area of low pressure, with a tendency to move northeast, was central near Little Rock, Ark., by the morning of the 3d it was central over Iowa, and on the morning of the 4th was over the Great Lakes, while persistently high pressure to the west and northwest of it, with a barometric gradient of from 0.90 to 1.00 inch, was present all of the time.

On the morning of the 2d a fall of from 20° to 30° in temperature had occurred over portions of the Dakotas, Nebraska, Iowa, and Minnesota, and it was still colder and temperature near zero at Huron on the morning of the 3d. It was but natural that the area of low pressure, beating its way northeast against this cold current, and high pressure north and west of it, should lose much more than the usual amount of the moisture. On its north and west sides that it was drawing from southern latitudes, in its slow progress toward the Lakes, falling in the form of snow over eastern South Dakota, which country was in unusually favorable position in relation to the formation and progress of the low area to receive the excess of its precipitation.

## NOTES BY THE EDITOR.

### THE EARLY HISTORY OF THE THERMOMETER AND BAROMETER.

In the Annual Report of the Chief Signal Officer for 1887 will be found a "Treatise on Meteorological Apparatus and Methods," which is usually bound up separately as Part II of the Report, and in which the Editor has brought together some information with regard to the history and development of various apparatus. Since then important contributions to this subject have been made by Gerland, and more recently Dr. Hellmann has laid us under still further obligations by including in his reprints of meteorological classics a volume on the history of the barometer and thermometer. At a recent meeting of the German Meteorological Association, in Berlin, Dr. Hellmann made the following remarks with regard to this volume, which are quoted from the Berlin *Vossische Zeitung:*

It considers the history of meteorological instruments in that it publishes the correspondence of Torricelli with Ricci on the measurement of atmospheric pressure, and also the description of the thermometer and hygrometer given by the Academy del Cimento in Florence. Torricelli's letters are of the greatest importance in the study of the history of the barometer. They treat of the experiment with quicksilver made by Viviani in the year 1643 in Florence at the suggestion of Torricelli, and are the only proof of this discovery, since Torricelli himself never published any other account. They are dated June 11 and 28, 1644, and show that Torricelli already knew at that time that the mercury in the tube changes its height because the air is sometimes heavier and denser, sometimes lighter and rarer. They also show that he made the experiment with a view to obtaining an instrument with which to observe the atmospheric changes. The news of Torricelli's experiment reached France through a letter from Ricci as early as 1644, but it was only in the summer of 1646 that the experiment was successfully accomplished, apparently because they could not earlier obtain the glass tubes needed to actually carry out the barometric test.

The report of the Academy del Cimento relates to the early history of the measurement of heat and moisture. It can not now be determined with absolute certainty who made the first attempt to measure the temperature, but it is probable that it was Galileo, who, stimulated by the Greek author, Heron, made a thermoscope at the end of the sixteenth or beginning of the seventeenth century. Possibly the physician, Santorio, in Padua, had, independently of Galileo, made thermoscopes that he applied first to practical medicine, as in the measurement of fever; also to scientific purposes, as in the measurement of the heat radiated from the moon. Santorio also was influenced by Heron's writings, so that in the invention of the thermometer we have presented to us the extremely rare case of the first beginnings of physical measurements being stimulated and expedited by the science of classical times. The first description and drawing of the new instrument was given by Biancani, who also first used the word "thermoscope" in the year 1620, whereas the word "thermometer" is found for the first time in a small book by the Jesuit Jean Leurichon, in the year 1624. There is little that is reliable that can be said as to the next following period in the history of the development of the thermometer. We only know that already, in 1632, the French physician, Jean Ray, instead of Galileo's air thermoscope, used water thermometers whose tubes were not, indeed, closed at the top, and that probably in 1641 the Duke Ferdinand II of Tuscany, first conceived the idea of closing the tube at the top so as to exclude the air, thus giving to the thermometer essentially the form in which it was afterwards known under the name of the "Florentine thermometer." Improvements in the instrument were made by the Academy del Cimento (that is to say the Academy of Experimentation which was founded in 1657 in Florence by Leopold, the brother of the reigning Grand Duke, and which, after 10 years' existence, was dissolved in consequence of the elevation of the Prince to the College of Cardinals). The most important results of the experimental work done by the Academy were recorded in a day book from which source the Secretary of the Academy, Lorenzo Magalotti, drew the material for his famous work *Saggi di naturali esperienze fatte nell' Academie del Cimento.*

[A complete English translation of this work was published by the Royal Society of London under the title of: Essays of Natural Experiments made in the Academy del Cimento, under the Protection of the Most Serene Prince Leopold of Tuscany. Written in Italian by the Secretary of that Academy. Englished by Richard Waller, Fellow of the Royal Society. London, I. T. Printed for Benjamin Alsop at the Angel and Bible in the Poultrey, over against the Church, 1684.]

The volume recently published by Dr. Hellmann reprints the first two chapters of the *Saggi*, as also drawings of three thermometers, namely, the so-called large, hundred-scale, the smaller, fifty-scale, and a very complicated spiral thermometer. The weakest point in the construction of these thermometers, which were very rapidly distributed throughout Europe, was the establishment of the scale, since the academicians knew only one fixed point, that of the melting point of snow, which occurred at about 13.5° on these thermometers. Nevertheless, in consequence of the excellent work of the glass blower, these instruments were very reliable and comparable among themselves.

### A REPRINT OF EARLY METEOROLOGICAL CHARTS.

Among his recent "neudrücke," or reprints of classics in meteorology and terrestrial magnetism, Dr. Hellmann has published a volume illustrating the progress of meteorological chartography, in which he reprints (1) the first wind chart, which was prepared by Edward Halley in 1686, and which is also the oldest of all meteorological charts; (2) the first chart of isotherms, which Alexander von Humboldt published

in 1817; (3) a facsimile of one of the thirteen synoptic charts prepared by Elias Loomis in 1843, in connection with his investigation of two storms that occurred in 1842; (4) the weather chart, with isobars, that Le Verrier published in France on September 11, 1863, as the first daily weather chart on the basis of telegraphic reports; (5) the chart, with isobars, which is twelve years older than Le Verrier's, being that which was published daily for sometime in the year 1851, during the World's Fair at London; (6) a facsimile of the first chart of average isobars for any country, being that published for France in 1864 by Renou.

These reprints by Dr. Hellmann awaken one's interest in the history of the development of meteorology, and we can but hope that, in the abundance of his knowledge of ancient literature, he will discover some early American works that are worthy of being reprinted among his classics.

## MEXICAN CLIMATOLOGICAL DATA.

In order to extend the isobars and isotherms southward so that the students of weather, climate and storms in the United States may properly appreciate the influence of the conditions that prevail over Mexico the Editor has translated the following tables from the current numbers of the *Boletin Mensual* as published by the Central Meteorological Observatory of Mexico. The data there given in metric measures have been converted into English measures. The barometric means are as given by mercurial barometers under the influence of local gravity, and therefore need reductions to standard gravity, depending upon both latitude and altitude; the influence of the latter is rather uncertain, but that of the former is well known. For the sake of conformity with the other data published in this REVIEW these corrections for local gravity have not been applied. One additional station, Topolobampo, is published at the end of Table II.

*Mexican data for December*, 1896.

| Stations. | Altitude. | Mean barometer. | Temperature. | | | Relative humidity. | Precipitation. | Prevailing direction. | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Max. | Min. | Mean. | | | Wind. | Cloud. |
| | *Feet.* | *Inch.* | ° *F.* | ° *F.* | ° *F.* | % | *Inch.* | | |
| Aguascalientes | 6,112 | 23.86 | 65.1 | 33.4 | 59.4 | 36 | 0.00 | n. | |
| Campeche | | | | | | | | | |
| Colima (Seminario) | 1,600 | | | | | | | | |
| Colima | | | | | 75.4 | | | | |
| Culiacan | 112 | | | | | | | | |
| Guadalajara (O. d. E.) | 5,141 | 25.03 | 77.0 | 29.8 | 57.6 | 36 | 0.00 | nw. | w. |
| Guanajuato | 6,761 | 23.73 | 73.8 | 37.2 | 55.6 | 48 | T. | sw. | sw. |
| Jalapa | 4,757 | 25.62 | 87.8 | 42.8 | 57.4 | 80 | 1.50 | n. | |
| Lagos (L. G.) | 6,275 | 24.19 | 77.5 | 25.5 | 54.0 | 63 | 0.00 | ne. | ne. |
| Leon | 5,901 | 24.35 | 74.8 | 27.7 | 54.5 | 51 | 0.00 | ssw. | sw. |
| Magdalena (Sonora) | | | 68.0 | 50.0 | 59.0 | | 1.73 | nne. | n. |
| Mazatlan | 25 | 29.96 | 83.1 | 61.3 | 73.9 | 64 | T. | nw. | sw. |
| Merida | 50 | 30.04 | 89.8 | 55.4 | 71.6 | 76 | 2.09 | ne. | sw. |
| Mexico (Obs. Cent.) | 7,469 | 23.11 | 71.6 | 34.7 | 52.0 | 61 | 0.61 | nw. | sw. |
| Mexico (E. N. de S.) | 7,480 | | | | | | | | |
| Morelia (Seminario) | 6,401 | 24.01 | 78.4 | 34.7 | 53.8 | 67 | 0.33 | ne. | w. |
| Oaxaca | 5,164 | 25.13 | 81.9 | 37.6 | 61.0 | 62 | 0.76 | nw. | ne. |
| Pabellon | 6,212 | | | | | | | | |
| Pachuca | 7,956 | 22.56 | 73.0 | 33.8 | 50.5 | 64 | 0.00 | nne. | ne. |
| Puebla (Col. d. Est) | 7,118 | | | | | | | | |
| Puebla (Col. Cat.) | 7,112 | 23.33 | 75.2 | 35.2 | 55.0 | 65 | 0.53 | e. | ne. |
| Queretaro | 6,070 | | | | | | | | |
| Saltillo (Col. S. Juan) | 5,377 | | | | | | | | |
| San Luis Potosi | 6,202 | 24.20 | 70.7 | 31.3 | 54.4 | 65 | 0.14 | e. | w. |
| Silao | 6,063 | 24.34 | 69.6 | 40.3 | 57.2 | 65 | T. | w. | sw. |
| Tacámbaro | | | | | | | | | |
| Tacubaya (Obs. Nac.) | 7,620 | | | | | | | | |
| Tampico (Hos. Mil.) | 38 | | | | | | | | |
| Tehuacan | 5,453 | | | | | | | | |
| Toluca | 8,612 | 21.93 | 68.7 | 25.2 | 49.1 | 62 | 1.06 | | |
| Trejo (H. de, S., Gto.)* | 6,011 | | | | | | 0.00 | e. | |
| Trinidad† | 6,011 | | | | | | | | |
| Veracruz | 48 | | | | | | | | |
| Zacatecas | 8,015 | 22.56 | 74.8 | 24.8 | 52.0 | 52 | 0.00 | ne. | ne. |
| Zapotlan (Seminario) | 5,125 | | | | | | | | |

*Trejo appears to have the same altitude as the next station, Trinidad, but this may be a typographical error in the December *Boletin*.
†Trinidad is 14 kilometers east-southeast of Leon.

## ANNUAL MEANS FOR 1895.

The following table is taken from the general synopsis published in the *Boletin Mensual* for December, 1896, page 171, which is a summary of the annual tables published at occasional intervals in the *Boletin* during the past year. A corresponding synopsis for 1896 will, doubtless, also soon become available. These annual summaries are essential as a basis for the reduction of the pressure and temperature to sea level, which reduction must be carried out for normal and annual values before discussing monthly means or individual observations. The altitudes here given are taken from the respective annual tables from which this synopsis is quoted; unfortunately they differ sometimes from the altitudes given in the monthly tables for 1896, but we may not go far wrong in assuming that the barometers have remained in the same location during both these years and that the changes in the figures are simply the result of a revision of the adopted altitudes. Nothing is published as to the manner in which these altitudes have been determined, possibly many of them may be the result of barometric computations, in which case the reduced pressures will have a corresponding uncertainty. In accordance with the other Mexican data the barometric means have not been reduced to standard gravity and, in fact, the values of local gravities at the respective stations is, as yet, not known by actual observation but may be approximately computed by Mr. Putnam's formula, as given on page 463 of the MONTHLY WEATHER REVIEW for December, 1896.

*Annual synopsis for* 1895; *Mexican stations.*

| Stations. | Altitude for 1895. | Barometer (mean). | Temperature. | | | Mean humidity. | Days with rain. | Total precipitation. | Wind, prevailing direction. | Clouds. | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Mean annual. | Maximum (absolute). | Minimum (absolute). | | | | | Mean cloudiness. | Prevailing direction. |
| | | | | 91.9 | | % | | | | % | |
| Guanajuato | *6,640 | 23.68 | 65.5 | 89.6 | 36.0 | 48 | 100 | 22.68 | ssw. | 40 | ne. |
| Jalapa | 4,757 | 25.55 | 63.5 | 91.0 | 33.8 | 82 | 147 | 51.20 | nnw | | |
| Leon | 5,901 | 24.29 | 65.7 | 91.0 | 32.0 | 47 | 113 | 20.92 | § | 44 | sw. |
| Mazatlan | 25 | 29.92 | 76.8 | 103.6 | 56.8 | 77 | 75 | 42.85 | nw. | 34 | sw. |
| Merida | 50 | 29.95 | 78.4 | 84.9 | 47.8 | 71 | 97 | 29.29 | ne. | 47 | se. |
| Mexico | *7,472 | 23.07 | 60.3 | 87.8 | 32.9 | 57 | 145 | 22.01 | n. | 50 | ne. |
| Morelia | 6,401 | 23.96 | 61.9 | 93.7 | 37.4 | 63 | 125 | 32.96 | ssw. | 49 | w. |
| Oaxaca | 5,164 | 25.11 | 69.4 | 90.2 | 39.2 | 61 | 109 | 28.08 | w. | 44 | e. |
| Pachuca.‡ | 7,956 | 22.59 | 57.9 | 83.8 | 33.4 | 59 | 106 | 10.86 | nne. | 37 | ne. |
| Puebla (C. d. E.) | 7,118 | 23.35 | 60.6 | 91.4 | 32.9 | 60 | 113 | 23.55 | ne. | 45 | n. |
| Puebla (Col. Cat.) | 7,112 | 23.37 | 63.0 | 90.1 | 37.6 | 60 | 124 | 27.09 | e. | 37 | se. |
| Queretaro | 6,070 | 24.18 | 64.9 | 90.3 | 32.9 | 59 | 67 | 9.95 | e. | | |
| Real d. Monte† | 9,095 | 21.59 | 55.4 | 89.6 | 31.6 | | 83 | 24.45 | | 37 | |
| Saltillo | 5,377 | 24.85 | 63.7 | 89.3 | 51.8 | 72 | 77 | 23.46 | ne. | 33 | n. |
| San Luis Potosi | 6,202 | 24.14 | 63.9 | 90.4 | 26.1 | 59 | 64 | 11.25 | e. | 41 | w. |
| Tacubaya | 7,620 | 22.97 | 58.6 | 81.5 | 26.6 | 61 | 136 | 24.72 | nw. | 44 | |
| Toluca | 8,612 | 21.91 | 54.9 | 90.0 | 24.4 | 59 | 154 | 26.16 | wsw | 44 | se. |
| Zacatecas | *8,189 | 22.54 | 60.1 | | 19.0 | 55 | 64 | 10.70 | sw. | 36 | se. |

*These altitudes for 1895 differ from those published in the respective monthly summaries for 1896. In the absence of positive information it may be assumed that the barometers were not removed, but that the adopted altitudes have been revised from time to time.
†This station does not appear among the monthly summaries of 1896.
‡The monthly and annual barometric means are published to the nearest tenth of a millimeter, but for all other stations to the nearest hundredth.
§Sw. & wsw.

## METEOROLOGY IN THE PUBLIC SCHOOLS.

In the MONTHLY WEATHER REVIEW for December, 1895, Vol. XXIII, page 458, the Editor has referred to the excellent results attained in school work by utilizing, as a basis for discussion and mental training, such elementary observations of the weather as can be made by any child. When the scholars in any class are encouraged to keep personal diaries and notes of atmospheric phenomena their perceptive faculties are rapidly developed; when these diaries are compared and the ideas that are suggested by the pupils are discussed under the leadership of a wise teacher, the analytical faculties of the mind are developed, the study of nature is encouraged, erroneous ideas are supplanted by careful generalizations, and experience comes to be esteemed more highly than inherited myths and legends. The highest development of this method of studying meteorology will undoubtedly be